

## REPORT DOCUMENTATION PAGE

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New Microlayer and Nanolayer Polymer Composites		DAAG55-98-1-0311	
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E. Baer and A. Hiltner			
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Case Western Reserve University 10900 Euclid Avenue Cleveland, Ohio 44106-7202			
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13. ABSTRACT (Maximum 200 words)			
<p>During the period, new types of micro- and nano-layered polymeric composite systems were created with specific property combinations. Various materials systems with two and three components were produced for the first time. These had novel characteristics due to structure control as a function of scale and inter-layer adhesion.</p> <p>Highlights include:</p> <ul style="list-style-type: none"> <li>(1) Development of clear nano-layered composites with improved ballistic performance characteristics;</li> <li>(2) Creation of conducting micro-layered composites by controlled interdiffusion;</li> <li>(3) Microlayered structures with highly anisotropic conductivity</li> </ul>			
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**1. Manuscripts Submitted and Published**

Mechanical Behavior of Polymer Microlayers, by J. Kerns,  
A. Hsieh, A. Hiltner and E. Baer, Macromol. Symp. (in press).

Relationships of Hierarchical Structure to Mechanical Properties,  
by D. Jarus, A. Hiltner and E. Baer, Macromol. Symp. (in press)

Solid State Structure and Melting Behavior of Interdiffused  
Polyethylene in Microlayers, by T. Schuman, S. Nazarenko,  
E.V. Stepanov, S.N. Magonov, A. Hiltner and E. Baer,  
Polymer (in press)

Creating Layers of Concentrated Inorganic Particles by  
Interdiffusion of Polyethylene in Microlayers, by S. Nazarenko,  
M. Dennison, T. Schuman, E.V. Stepanov, A. Hiltner and E. Baer,  
J. Appl. Polym. Sci. (in press)

Microlayer Structures with Anisotropic Conductivity, by  
S. Nazarenko, A. Hiltner and E. Baer, J. Mater. Sci., 33, 1-10  
(1998).

**2. Scientific Personnel**

Faculty:

- E. Baer, professor
- A. Hiltner, professor
- S. Nazarenko, assistant professor

Research Staff and Graduate Students

- E. Stepanov, Senior Research Associate
- T. Schuman, Ph.D. candidate
- M. Parsons, Ph.D. candidate
- D. Jarus, PhD. candidate
- J. Kerns M.S. candidate
- M. Dennison, B.S. candidate

**3. Inventions**

None

#### 4. Scientific Progress and Accomplishments

Transparent nanolayered composites with more than 4,000 layers have been created of both polycarbonate/styrene acrylonitrile copolymers and polycarbonate/polymethylmethacrylate. A composition of 80% polycarbonate, with improved solvent (craze) resistance, achieved the ballistic performance of polycarbonate.

Novel electro-mechanical composites have been made with highly anisotropic electrical properties using interdiffusion between layers under controlled thermal conditions. The elastomeric nature of these systems has been used to develope sensitive sensors that function under large reversible deformation.

#### 5. Technology Transfer

Four companies, Kimberly-Clark, American National Can, International Paper and Dow Chemical are utilizing the microlayer technology developed under this ARO program to create new products.

Also, under this contract, composites have been made for the Army Research Laboratory, at Chestnut Run. Structure-property relationships have been established for these systems.